JAPANESE [JP,10-056420,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] While carrying out spectrum diffusion of the modulating signal-ed by which digital modulation was carried out with the transmit data in the base station and the mobile station and transmitting to a distant office The CDMA system from a base station to a mobile station by which it gets down and the frequency of a circuit differs from the frequency of the going-up circuit of the hard flow, It is the CDMA adaptation modulation approach of changing said digital modulation method accommodative. Each of a base station and a mobile station The amount of interference showing the ratio of the signal component of choice of the received waves of a local station and an interference signal component is detected. Among two or more digital modulation methods defined beforehand, a transmission error rate becomes below a predetermined value under said detected amount of interference, and the modulation technique which can transmit most many amount of information is chosen from from. The CDMA adaptation modulation approach characterized by determining the digital modulation method at the time of the data transmission of the next time of a distant office by transmitting the symbol information which shows the this selected modulation technique to a distant office with transmit data.
[Claim 2] It is the CDMA adaptation modulation approach according to claim 1 characterized by performing detection of said amount of interference in a base station based on the number of channels in use in the base station concerned.
[Claim 3] The CDMA adaptation modulation approach according to claim 1 characterized by detecting said amount of interference in a mobile station by the common diffusion sign which intersects perpendicularly each base station to the pattern for interference wave presumption with all of the diffusion sign which is common and is assigned to all mobile stations to all mobile stations performing spectrum diffusion, transmitting, and extracting this with a mobile station.
[Claim 4] It is the CDMA adaptation modulation approach according to claim 3 characterized by being transmitted from one base station for every transmission frame of data so that each base station may not perform transmission of said pattern for interference wave presumption from each base station to coincidence.
[Claim 5] Said pattern for interference wave presumption contains the number of channels in use in the identification code which shows the base station which transmitted the pattern for interference wave presumption concerned at least, and the base station concerned. Each mobile station It considers as the total received power from the base station where the identification code contained in said pattern for interference wave presumption shows the product of the receiving level of said pattern for interference wave presumption, and the number of channels in use included in this pattern for interference wave presumption. In this way, the CDMA adaptation modulation approach according to claim 4 characterized by detecting said amount of interference from the sum of the total received power from each base station and the receiving level of the data signal addressed to a local station which were called for.
[Claim 6] A base station and a mobile station are the adaptation modulation CDMA approach according to claim 1 characterized by transmitting said symbol information to a distant office with data, and determining the digital recovery method of the frame concerned in a distant office when performing digital modulation by the modulation technique which said symbol information

transmitted from the distant office shows and transmitting the following frame.
[Claim 7] A base station and a mobile station are the CDMA adaptation modulation approach according to claim 1 characterized by determining the digital recovery approach of the received data in the following frame which sent said symbol information to the distant office from said sent symbol information.
[Claim 8] Each of a base station presumes the amount of interference which the transmission wave from one to the base station concerned of a mobile station receives. A transmission error rate becomes below a predetermined value under the presumed this amount of interference, and it chooses from two or more digital modulation methods which were able to define beforehand the digital modulation method with the largest transmission capacity. The amount presumption means of base station interference for outputting the mobile station symbol which shows the this selected digital modulation method, Add the mobile station symbol outputted from said amount presumption means of base station interference for every frame of transmit data, and a transmitting data frame is constituted. The base station adaptation modulation means established for every channel for becoming it irregular that it is also with the digital modulation method which the inputted base station symbol shows by said transmitting data frame, The interference wave presumption pattern generating means for generating the interference wave presumption pattern for presuming the amount of received wave interference in a mobile station to the timing which does not lap in time in each base station, The 1st spectrum diffusion means established for said every channel for carrying out spectrum diffusion of the output of said base station adaptation modulation means with the diffusion sign given to the mobile station connected to the channel concerned corresponding to an adaptation modulation means, The 2nd spectrum diffusion means for intersecting perpendicularly with all the diffusion signs to which it was given by all mobile stations, and carrying out spectrum diffusion of the output of said interference wave presumption pattern generating means to a common diffusion sign being in all base stations, The base station spectrum back-diffusion-of-electrons means established for every channel for carrying out the spectrum back diffusion of electrons of the transmission wave from a mobile station using the diffusion sign concerned corresponding to a mobile station, While having a base station recovery means for taking out the data and the base station symbol which restored to the output of this base station spectrum back-diffusion-of-electrons means, and have been transmitted from the mobile station, and inputting this base station symbol into said base station adaptation modulation means The 1st spectrum back-diffusion-of-electrons means for each of a mobile station to perform the spectrum back diffusion of electrons of a received wave using the diffusion sign concerned corresponding to a mobile station, The 2nd spectrum back-diffusion-of-electrons means for performing the spectrum back diffusion of electrons of a received wave using said common diffusion sign, and outputting said interference wave presumption pattern, The mobile station recovery means for taking out the data which restored to the output of said 1st spectrum back-diffusion-of-electrons means, and have been transmitted from a base station, and said mobile station symbol, The amount of interference which the transmission wave from the output of said 2nd spectrum back-diffusion-of-electrons means to the mobile station concerned receives is presumed. A transmission error rate becomes below a predetermined value under the presumed this amount of interference, and it chooses from two or more digital modulation methods which were able to define beforehand the digital modulation method with the largest transmission capacity. The amount presumption means of mobile station interference for outputting the base station symbol which shows the this selected digital modulation method, Add the base station symbol outputted from said amount presumption means of mobile station interference for every frame of transmit data, and a transmitting data frame is constituted. The mobile station adaptation modulation means for becoming it irregular that it is also with the digital modulation method which the mobile station symbol outputted from said mobile station recovery means shows by said transmitting data frame, The CDMA adaptation modulation system characterized by having a mobile station spectrum diffusion means for carrying out spectrum diffusion of the output of this mobile station adaptation modulation means with the diffusion sign concerned corresponding to a mobile station.
[Claim 9] While constituting so that it may be generated to the timing with which the

interference wave presumption pattern from the transmitting data frame inputted into said base station adaptation modulation means and said interference wave presumption pattern generating means does not lap in time The 1st [of said base station] and 2nd spectrum diffusion means are constituted so that one spectrum diffusion means may be used by time sharing. The CDMA adaptation modulation system according to claim 8 characterized by furthermore constituting the 1st [of said mobile station], and 2nd spectrum back-diffusion-of-electrons means so that one spectrum back-diffusion-of-electrons means may be used by time sharing.

[Claim 10] Said amount detection means of base station interference is a CDMA adaptation modulation system according to claim 8 or 9 characterized by presuming said amount of interference based on the number of channels in use in the base station concerned.

[Claim 11] Said pattern for interference wave presumption contains the number of channels in use in the identification code which shows the base station which transmitted the pattern for interference wave presumption concerned at least, and the base station concerned. Said amount detection means of mobile station interference is made into the total received power from the base station where the identification code contained in said pattern for interference wave presumption shows the product of the receiving level of said pattern for interference wave presumption, and the number of channels in use included in this pattern for interference wave presumption. In this way, the CDMA adaptation modulation system according to claim 8 or 9 characterized by detecting said amount of interference from the sum of the total received power from each base station and the receiving level of the data signal addressed to a local station which were called for.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the suitable CDMA adaptation modulation system especially for digital mobile radios, and its approach with respect to the CDMA adaptation modulation system which chose the modulation technique when carrying out spectrum diffusion and transmitting a digital modulation signal accommodative, and its approach.
[0002]
[Description of the Prior Art] the explanatory view of the CDMA system (Code Division Multiple Access System) by which drawing 3 used the spectrum diffusion method for the mobile radio system — it is — mobile stations 32 and 32 and ... it is the system which shares the same frequency within the same cel by using a diffusion sign (sign which intersects perpendicularly mutually) which is different in **. That is, each channel is separable by setting up the transmit frequencies from a base station 31 so that each mobile stations 32 and 32 and the diffusion sign used by ... may intersect them perpendicularly mutually, although two or more channels will superimpose f1 and the transmit frequencies from a mobile station on f2, then the same frequency. Moreover, since a radio signal has wide band width of face, it is strong to frequency complement system phasing, distortion and an interference wave, or active jamming, is excellent also in secrecy nature, and is used for the land-mobile communication link.
[0003]
[Problem(s) to be Solved by the Invention] Although drawing 3 showed only one base station, two or more base stations may exist in the same cel in fact, not only the transmission wave of the multiple channel from these base stations but the transmission wave from the cel which adjoined goes into one mobile station, and these are all the signals of a frequency f1. The same is said of the transmission wave of the frequency f2 which arrives at each base station. In a CDMA system, only the transmission wave of a desired channel must be taken out from the transmission wave of these large number using the orthogonality of a diffusion sign. However, since the orthogonality of the diffusion sign between each user is not perfect, with increase of the number of users, a distortion component serves as an interference wave and increases it. Therefore, the usable number of channels is naturally restricted by total of the amount of interference from the same cel and a contiguity cel, and modulation parameters, such as an information transmission rate of each channel, are decided to satisfy a certain fixed transmission error rate to the amount of the maximum interference under the maximum number of users to assume.
[0004] however, the number of channels set up in fact — it is rare that the user is using all and a low area also has the operating frequency of a channel especially depending on an area. Therefore, at the quite high rate of time amount, the amount of interference of a propagation way decreases according to there being few users circuit in use, and the propagation way situation is good. In such a case, although more nearly high-speed transmission is possible, since it transmitted conventionally only with the transmission speed restrained with the amount of the maximum interference which may happen, frequency use effectiveness had much futility, in view of the information-transmission capacity of the circuit of parenchyma. That is, since it was a

fixed rate in spite of being in the situation in which a high speed and a lot of data transmission are more possible, there was a fault that it could not respond to the high speed and a lot of data transmission which are called for by multimedia-ization depending on a situation.
[0005] The purpose of this invention is to offer the CDMA adaptation modulation system to which it was made to change the modulation technique of digital modulation accommodative according to interference wave level, and its approach in order to raise frequency use effectiveness.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, while carrying out spectrum diffusion of the modulating signal-ed by which digital modulation was carried out with the transmit data in the base station and the mobile station in this invention and transmitting to a distant office The CDMA system from a base station to a mobile station by which it gets down and the frequency of a circuit differs from the frequency of the going-up circuit of the hard flow, It is the CDMA adaptation modulation approach of changing said digital modulation method accommodative. Each of a base station and a mobile station The amount of interference showing the ratio of the signal component of choice of the received waves of a local station and an interference signal component is detected. Among two or more digital modulation methods defined beforehand, a transmission error rate becomes below a predetermined value under said detected amount of interference, and the modulation technique which can transmit most many amount of information is chosen from from. The CDMA adaptation modulation approach characterized by determining the digital modulation method at the time of the data transmission of the next time of a distant office is offered by transmitting the symbol information which shows the this selected modulation technique to a distant office with transmit data.
[0007] Furthermore by this invention, each of a base station presumes the amount of interference which the transmission wave from one to the base station concerned of a mobile station receives. A transmission error rate becomes below a predetermined value under the presumed this amount of interference, and it chooses from two or more digital modulation methods which were able to define beforehand the digital modulation method with the largest transmission capacity. The amount presumption means of base station interference for outputting the mobile station symbol which shows the this selected digital modulation method, Add the mobile station symbol outputted from said amount presumption means of base station interference for every frame of transmit data, and a transmitting data frame is constituted. The base station adaptation modulation means established for every channel for becoming it irregular that it is also with the digital modulation method which the inputted base station symbol shows by said transmitting data frame, The interference wave presumption pattern generating means for generating the interference wave presumption pattern for presuming the amount of received wave interference in a mobile station to the timing which does not lap in time in each base station, The 1st spectrum diffusion means established for said every channel for carrying out spectrum diffusion of the output of said base station adaptation modulation means with the diffusion sign given to the mobile station connected to the channel concerned corresponding to an adaptation modulation means, The 2nd spectrum diffusion means for intersecting perpendicularly with all the diffusion signs to which it was given by all mobile stations, and carrying out spectrum diffusion of the output of said interference wave presumption pattern generating means to a common diffusion sign being in all base stations, The base station spectrum back-diffusion-of-electrons means established for every channel for carrying out the spectrum back diffusion of electrons of the transmission wave from a mobile station using the diffusion sign concerned corresponding to a mobile station, While having a base station recovery means for taking out the data and the base station symbol which restored to the output of this base station spectrum back-diffusion-of-electrons means, and have been transmitted from the mobile station, and inputting this base station symbol into said base station adaptation modulation means The 1st spectrum back-diffusion-of-electrons means for each of a mobile station to perform the spectrum back diffusion of electrons of a received wave using the diffusion sign concerned corresponding to a mobile station, The 2nd spectrum back-diffusion-of-electrons means for performing the spectrum back diffusion of electrons of a received wave

using said common diffusion sign, and outputting said interference wave presumption pattern, The mobile station recovery means for taking out the data which restored to the output of said 1st spectrum back-diffusion-of-electrons means, and have been transmitted from a base station, and said mobile station symbol, The amount of interference which the transmission wave from the output of said 2nd spectrum back-diffusion-of-electrons means to the mobile station concerned receives is presumed. A transmission error rate becomes below a predetermined value under the presumed this amount of interference, and it chooses from two or more digital modulation methods which were able to define beforehand the digital modulation method with the largest transmission capacity. The amount presumption means of mobile station interference for outputting the base station symbol which shows the this selected digital modulation method, Add the base station symbol outputted from said amount presumption means of mobile station interference for every frame of transmit data, and a transmitting data frame is constituted. The mobile station adaptation modulation means for becoming it irregular that it is also with the digital modulation method which the mobile station symbol outputted from said mobile station recovery means shows by said transmitting data frame, The CDMA adaptation modulation system characterized by having a mobile station spectrum diffusion means for carrying out spectrum diffusion of the output of this mobile station adaptation modulation means with the diffusion sign concerned corresponding to a mobile station is offered.

[0008]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. Drawing 1 is the block diagram showing the example of the CDMA adaptation modulation structure of a system which becomes this invention, and shows one base station and one mobile station. In this drawing A base station transmit data The adaptation modulation section 110 for information data for becoming irregular, and its modulation output The spectrum diffusion section 111 which carries out spectrum diffusion, the frame timing signal generating section 112, the interference wave presumption pattern generating section 113, the spectrum diffusion section 114 that carries out spectrum diffusion of the output pattern, the interference wave presumption section 115, the transmission-and-reception splitter 118, It consists of the spectrum back-diffusion-of-electrons section 116 and recovery section 117 grade. On the other hand, a mobile station Transmit data The adaptation modulation section 120 for becoming irregular, and its modulation output The spectrum back-diffusion-of-electrons section 124 for taking out the interference wave presumption section 123 for presuming an interference wave, and a data signal from the spectrum back-diffusion-of-electrons section 122 for taking out the spectrum diffusion section 121 and the interference wave presumption pattern which carry out spectrum diffusion, and its output, and its output It consists of the recovery section 125 for getting over, and transmission-and-reception splitter 126 grade. In addition, the adaptation modulation section 110, the spectrum diffusion section 111, the spectrum back-diffusion-of-electrons section 116, and the recovery section 117 are installed by the number of channels which can be transmitted and received to coincidence in the base station.

[0009] Drawing 4 shows a transmission format of the data in this CDMA adaptation modulation system, and shows the signal transmitted from three base stations and one mobile station. Each sending signal from each base station is a frequency f1, and, as for it from a mobile station, a frequency f2 is used. In addition, the detail of the information data TI of base stations 2 and 3 is omitting illustration. Hereafter, actuation of the system of drawing 1 is explained, referring to this drawing.

[0010] First, in a base station, the information data TI are outputted from the adaptation modulation section 110 for information data. As each frame of this information data TI is shown in drawing 4 , the symbol MIM which specifies the modulation technique which a mobile station transmits to the symbol MIB (symbol which shows the modulation technique which the present base station has transmitted) which shows the modulation technique specified as that anterior part from the mobile station, and a posterior part with degree frame is inserted. In the spectrum diffusion section 111, using a mutually different diffusion sign for every mobile station, spectrum diffusion is carried out and the information data TI from the adaptation modulation section 110 for information data are outputted. (Drawing 4 shows only one signal) On the other hand from

the interference wave presumption pattern generating section 113, the pattern TR for interference wave level presumption which inserted the redundant bit SYC for taking frame synchronization is outputted to the data REF in which identification code ID which shows the base station concerned, and the present number of users are shown. It is outputted by time sharing from each base station by the timing signal from the frame timing signal generating section 112, and intersects perpendicularly also with the diffusion sign for which mobile stations in the spectrum diffusion section 114, and spectrum diffusion is carried out by the common common diffusion sign to each mobile station, and this signal TR is transmitted through the transmission-and-reception splitter 118.
 [0011] In the receive section of a base station, the data signal from a mobile station is received and the back diffusion of electrons is performed in the spectrum back-diffusion-of-electrons section 116, and in the recovery section 117, the modulation technique of the frame is presumed and it gets over. And the modulation technique MIB which was specified, Symbol MIB, i.e., the mobile station, inserted in the posterior part of a frame, and which a base station transmits with degree frame is taken out, and it tells to the adaptation modulation section 110 for information data. The presumed approach of the modulation technique in the recovery section 117 is performed by judging the symbol MIM which shows the modulation technique of the frame which the current mobile station inserted in the frame anterior part of the information data TI outputted from a mobile station has transmitted. Moreover, since the control section which omitted illustration knows communication with which mobile station it is, the diffusion sign corresponding to the mobile station used in the spectrum diffusion section 111 in the case of transmission and reception and the spectrum back-diffusion-of-electrons section 116 is selected based on the information.

[0012] Next, the presumed approach of the interference wave level in a base station is described. You may think that it depends for the interference wave level of the signal from a mobile station on the number of users then connected in approximation. So, in the interference wave presumption section 115 of a base station, the relation between the range of the number of users and a modulation technique is defined beforehand, a modulation technique is defined from the number of users which is making current connection, and it considers as the symbol MIM sent to a mobile station. If there are few users and the number of users will increase using a modulation technique with many multiple values, it will be below a predetermined transmission error rate, and they will enable it to transmit more amount of information here, as the number of users and the relation of a modulation technique use a modulation technique with few multiple values.

[0013] Next, actuation of a mobile station is described. In a mobile station, the back diffusion of electrons of received data is performed using the diffusion sign assigned to the local station in the spectrum back-diffusion-of-electrons section 124, and the information data TI are taken out, and the modulation technique MIM which was specified from the symbol MIM, i.e., a base station, inserted in the posterior part of information data and which a mobile station transmits with degree frame is taken out, and it tells to the adaptation modulation section 120 at the same time it presumes a modulation technique and gets over in the recovery section 125. In the adaptation modulation section 120, the data of degree frame are transmitted using the told modulation technique. At this time, the symbol which shows that modulation technique MIM is inserted in the anterior part of a frame. Moreover, in the spectrum back-diffusion-of-electrons section 122, the back diffusion of electrons of the pattern TR for interference wave level presumption from a base station is performed using the aforementioned common diffusion sign. In the interference wave presumption section 123, presumption and frame synchronization of interference wave level are performed as follows from the received pattern TR for interference wave level presumption. In addition, the presumed approach of the modulation technique in the recovery section 125 is presumed from the symbol MIB which shows the modulation technique of the frame by which current transmission is carried out inserted in the anterior part of a frame like the time of a base station.

[0014] Next, the presumed approach of the interference wave level in a mobile station is described. The pattern TR for interference wave level presumption which the back diffusion of electrons was carried out and was taken out in the spectrum back-diffusion-of-electrons

section 122 can consider that the power of the pattern TR is the received power for one channel from the base station which transmitted TR at the time, although it gets over like data in the interference wave presumption section 123. Since I and Q component are usually taken out by rectangular detection on the occasion of a recovery as the detection approach of this received power, it can ask by the operation of 1/2 from this component (I2+Q2). Moreover, since the number of users and identification code ID under communication in the base station concerned are contained in Pattern TR as mentioned above, when received power of the pattern TR from a base station j is made into Pj and the number Uj of users, the interference wave presumption section 123 detects Pj of the sequential above, and Uj from the pattern TR for interference wave presumption sent by time sharing, as shown in drawing 4 R> 4, and is [Equation 1]. The total received power Pt is computed by Pt=sigma UjPj. Furthermore, the interference wave presumption section 123 detects the power Pm of the information data which the mobile station concerned received from spectrum back-diffusion-of-electrons section 124 output, and is [Equation 2] as interference wave level D/U. D/U=Pm/(Pt-Pm)

********. And according to this interference wave level D/U, a modulation technique is determined like the case of a base station, and let it be the symbol MIB which shows the modulation technique at the time of the transmission from the next base station. This symbol MIB is sent to the adaptation modulation section 120, is added to each frame posterior part of information data, and is transmitted to a base station.

[0015] The PE with which source resultant pulse numbers as shown, for example in drawing 5 differ as an example of the modulation technique in a base station or a mobile station is used. In this example, the interference wave level presumed in the interference wave presumption section of a base station or a mobile station is divided into three fields, and the threshold which determines that field is set to A and B (A<B). At this time, if it interference-wave level <=A Becomes, it A< interference-wave level <=B Comes to use 8PSK and it will be QPSK and B< interference wave level, a modulation output will be carried out by BPSK. Of course, a modulation technique may use for example, pi / 2 shift BPSK, pi / 4 shifts QPSK, etc. for everything [above] but three kinds. And it sets up so that the modulation technique of the number of multiple values which can transmit the information on many in the range in which a predetermined error rate can realize A and B as possible can be chosen.

[0016] According to the CDMA adaptation modulation system of this invention explained above, each of a base station and a mobile station The symbol which presumes the interference wave level of the input signal of a local station, determines the modulation technique with if possible many amounts of information transmissions which can be transmitted below by the transmission error rate predetermined in the bottom of the interference wave level, and shows the modulation technique by telling about to a distant office with data Even if a symbol rate is fixed, rather than the conventional method, average transmission capacity is increased and a deployment of a frequency can be aimed at. Moreover, the monitor means of interference wave level is formed in a mobile station, and if it moves to the location where interference wave level is small and is made to perform data transmission between base stations, it will become convenient when high-speed data transmission is required.

[0017] Drawing 2 is the block diagram showing another example of a configuration of the CDMA adaptation modulation system which becomes this invention, and the same circuit as drawing 1 attaches the same sign. Differing from the configuration of drawing 1 is the point that the spectrum diffusion section 211 of a base station and the spectrum back-diffusion-of-electrons section 224 of a mobile station are made to perform not only information data but diffusion or the back diffusion of electrons of an interference wave presumption pattern. Of course, to information data, it is a diffusion sign corresponding to a mobile station, and a common diffusion sign is used to an interference wave presumption pattern. Although information data and an interference wave presumption pattern are diffused and transmitted with this configuration by the diffusion sign which intersects perpendicularly, since its diffusion / back-diffusion-of-electrons means is based on the same hardware, it cannot transmit to coincidence like drawing 4 .

[0018] Corresponding to this, a transmission format of the information in the system of drawing

2 is considered as a configuration like drawing 6 . That is, from each base station, information data DAT A, the information data with which one of them consists of a symbol MIB of the anterior part and a hind symbol MIM, and the pattern P for interference wave level presumption are transmitted to time sharing. For this reason, if it is looking in one base station, with the frame to which the pattern P for interference wave level presumption is not transmitted, the time zone which a transmitting output stops intermittently will arise from that base station.
[0019] If the above-mentioned difference is removed, this system will operate like the system of drawing 1 R> 1, and will be useful to a deployment of a frequency too. Although circuitry becomes somewhat easy in the comparison with drawing 1 , since the die length of an informational transmission frame decreases like drawing 6 , only in the part, transmission efficiency will fall.
[0020] In addition, in the system of drawing 1 and drawing 2 explained above, each station determines the suitable modulation technique of a distant office from interference wave level by the local station mutually, and notifies it to a distant office, a distant office shall transmit with data the symbol which shows the modulation technique while becoming irregular by the notified modulation technique, and those who received this shall get over by reading the method. However, since the modulation technique of a distant office transmits from a local station from the first and it notifies, in the receiving side, the modulation technique of the distant office in degree frame is known. Therefore, even if a transmitting side does not transmit the symbol which shows its modulation technique, he memorizes the modulation technique of the distant office of which the partner was notified, and it may be made to perform a recovery with degree frame in a receiving side using it.
[0021]
[Effect of the Invention] According to this invention, since an adaptation modulation is gone up with going down and it can apply to the CDMA method using another frequency by the circuit, the capacity which can be transmitted can be increased and effectiveness is in a deployment of a frequency.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the suitable CDMA adaptation modulation system especially for digital mobile radios, and its approach with respect to the CDMA adaptation modulation system which chose the modulation technique when carrying out spectrum diffusion and transmitting a digital modulation signal accommodative, and its approach.

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PRIOR ART

[Description of the Prior Art] the explanatory view of the CDMA system (Code Division Multiple Access System) by which drawing 3 used the spectrum diffusion method for the mobile radio system — it is — mobile stations 32 and 32 and ... it is the system which shares the same frequency within the same cel by using a diffusion sign (sign which intersects perpendicularly mutually) which is different in **. That is, each channel is separable by setting up the transmit frequencies from a base station 31 so that each mobile stations 32 and 32 and the diffusion sign used by ... may intersect them perpendicularly mutually, although two or more channels will superimpose f1 and the transmit frequencies from a mobile station on f2, then the same frequency. Moreover, since a radio signal has wide band width of face, it is strong to frequency complement system phasing, distortion and an interference wave, or active jamming, is excellent also in secrecy nature, and is used for the land-mobile communication link.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, since an adaptation modulation is gone up with going down and it can apply to the CDMA method using another frequency by the circuit, the capacity which can be transmitted can be increased and effectiveness is in a deployment of a frequency.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Although drawing 3 showed only one base station, two or more base stations may exist in the same cel in fact, not only the transmission wave of the multiple channel from these base stations but the transmission wave from the cel which adjoined goes into one mobile station, and these are all the signals of a frequency f1. The same is said of the transmission wave of the frequency f2 which arrives at each base station. In a CDMA system, only the transmission wave of a desired channel must be taken out from the transmission wave of these large number using the orthogonality of a diffusion sign. However, since the orthogonality of the diffusion sign between each user is not perfect, with increase of the number of users, a distortion component serves as an interference wave and increases it. Therefore, the usable number of channels is naturally restricted by total of the amount of interference from the same cel and a contiguity cel, and modulation parameters, such as an information transmission rate of each channel, are decided to satisfy a certain fixed transmission error rate to the amount of the maximum interference under the maximum number of users to assume.
[0004] however, the number of channels set up in fact — it is rare that the user is using all and a low area also has the operating frequency of a channel especially depending on an area. Therefore, at the quite high rate of time amount, the amount of interference of a propagation way decreases according to there being few users circuit in use, and the propagation way situation is good. In such a case, although more nearly high-speed transmission is possible, since it transmitted conventionally only with the transmission speed restrained with the amount of the maximum interference which may happen, frequency use effectiveness had much futility, in view of the information-transmission capacity of the circuit of parenchyma. That is, since it was a fixed rate in spite of being in the situation in which a high speed and a lot of data transmission are more possible, there was a fault that it could not respond to the high speed and a lot of data transmission which are called for by multimedia-ization depending on a situation.
[0005] The purpose of this invention is to offer the CDMA adaptation modulation system to which it was made to change the modulation technique of digital modulation accommodative according to interference wave level, and its approach in order to raise frequency use effectiveness.

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, while carrying out spectrum diffusion of the modulating signal-ed by which digital modulation was carried out with the transmit data in the base station and the mobile station in this invention and transmitting to a distant office The CDMA system from a base station to a mobile station by which it gets down and the frequency of a circuit differs from the frequency of the going-up circuit of the hard flow, It is the CDMA adaptation modulation approach of changing said digital modulation method accommodative. Each of a base station and a mobile station The amount of interference showing the ratio of the signal component of choice of the received waves of a local station and an interference signal component is detected. Among two or more digital modulation methods defined beforehand, a transmission error rate becomes below a predetermined value under said detected amount of interference, and the modulation technique which can transmit most many amount of information is chosen from from. The CDMA adaptation modulation approach characterized by determining the digital modulation method at the time of the data transmission of the next time of a distant office is offered by transmitting the symbol information which shows the this selected modulation technique to a distant office with transmit data.
[0007] Furthermore by this invention, each of a base station presumes the amount of interference which the transmission wave from one to the base station concerned of a mobile station receives. A transmission error rate becomes below a predetermined value under the presumed this amount of interference, and it chooses from two or more digital modulation methods which were able to define beforehand the digital modulation method with the largest transmission capacity. The amount presumption means of base station interference for outputting the mobile station symbol which shows the this selected digital modulation method, Add the mobile station symbol outputted from said amount presumption means of base station interference for every frame of transmit data, and a transmitting data frame is constituted. The base station adaptation modulation means established for every channel for becoming it irregular that it is also with the digital modulation method which the inputted base station symbol shows by said transmitting data frame, The interference wave presumption pattern generating means for generating the interference wave presumption pattern for presuming the amount of received wave interference in a mobile station to the timing which does not lap in time in each base station, The 1st spectrum diffusion means established for said every channel for carrying out spectrum diffusion of the output of said base station adaptation modulation means with the diffusion sign given to the mobile station connected to the channel concerned corresponding to an adaptation modulation means, The 2nd spectrum diffusion means for intersecting perpendicularly with all the diffusion signs to which it was given by all mobile stations, and carrying out spectrum diffusion of the output of said interference wave presumption pattern generating means to a common diffusion sign being in all base stations, The base station spectrum back-diffusion-of-electrons means established for every channel for carrying out the spectrum back diffusion of electrons of the transmission wave from a mobile station using the diffusion sign concerned corresponding to a mobile station, While having a base station recovery means for taking out the data and the base station symbol which restored to the output of this base station spectrum back-diffusion-of-electrons means, and have been transmitted from the

mobile station, and inputting this base station symbol into said base station adaptation modulation means The 1st spectrum back-diffusion-of-electrons means for each of a mobile station to perform the spectrum back diffusion of electrons of a received wave using the diffusion sign concerned corresponding to a mobile station, The 2nd spectrum back-diffusion-of-electrons means for performing the spectrum back diffusion of electrons of a received wave using said common diffusion sign, and outputting said interference wave presumption pattern, The mobile station recovery means for taking out the data which restored to the output of said 1st spectrum back-diffusion-of-electrons means, and have been transmitted from a base station, and said mobile station symbol, The amount of interference which the transmission wave from the output of said 2nd spectrum back-diffusion-of-electrons means to the mobile station concerned receives is presumed. A transmission error rate becomes below a predetermined value under the presumed this amount of interference, and it chooses from two or more digital modulation methods which were able to define beforehand the digital modulation method with the largest transmission capacity. The amount presumption means of mobile station interference for outputting the base station symbol which shows the this selected digital modulation method, Add the base station symbol outputted from said amount presumption means of mobile station interference for every frame of transmit data, and a transmitting data frame is constituted. The mobile station adaptation modulation means for becoming it irregular that it is also with the digital modulation method which the mobile station symbol outputted from said mobile station recovery means shows by said transmitting data frame, The CDMA adaptation modulation system characterized by having a mobile station spectrum diffusion means for carrying out spectrum diffusion of the output of this mobile station adaptation modulation means with the diffusion sign concerned corresponding to a mobile station is offered.

[0008]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. Drawing 1 is the block diagram showing the example of the CDMA adaptation modulation structure of a system which becomes this invention, and shows one base station and one mobile station. In this drawing A base station transmit data The adaptation modulation section 110 for information data for becoming irregular, and its modulation output The spectrum diffusion section 111 which carries out spectrum diffusion, the frame timing signal generating section 112, the interference wave presumption pattern generating section 113, the spectrum diffusion section 114 that carries out spectrum diffusion of the output pattern, the interference wave presumption section 115, the transmission-and-reception splitter 118, It consists of the spectrum back-diffusion-of-electrons section 116 and recovery section 117 grade. On the other hand, a mobile station Transmit data The adaptation modulation section 120 for becoming irregular, and its modulation output The spectrum back-diffusion-of-electrons section 124 for taking out the interference wave presumption section 123 for presuming an interference wave, and a data signal from the spectrum back-diffusion-of-electrons section 122 for taking out the spectrum diffusion section 121 and the interference wave presumption pattern which carry out spectrum diffusion, and its output, and its output It consists of the recovery section 125 for getting over, and transmission-and-reception splitter 126 grade. In addition, the adaptation modulation section 110, the spectrum diffusion section 111, the spectrum back-diffusion-of-electrons section 116, and the recovery section 117 are installed by the number of channels which can be transmitted and received to coincidence in the base station.

[0009] Drawing 4 shows a transmission format of the data in this CDMA adaptation modulation system, and shows the signal transmitted from three base stations and one mobile station. Each sending signal from each base station is a frequency f1, and, as for it from a mobile station, a frequency f2 is used. In addition, the detail of the information data TI of base stations 2 and 3 is omitting illustration. Hereafter, actuation of the system of drawing 1 is explained, referring to this drawing.

[0010] First, in a base station, the information data TI are outputted from the adaptation modulation section 110 for information data. As each frame of this information data TI is shown in drawing 4 , the symbol MIM which specifies the modulation technique which a mobile station transmits to the symbol MIB (symbol which shows the modulation technique which the present

base station has transmitted) which shows the modulation technique specified as that anterior part from the mobile station, and a posterior part with degree frame is inserted. In the spectrum diffusion section 111, using a mutually different diffusion sign for every mobile station, spectrum diffusion is carried out and the information data TI from the adaptation modulation section 110 for information data are outputted. (Drawing 4 shows only one signal) On the other hand from the interference wave presumption pattern generating section 113, the pattern TR for interference wave level presumption which inserted the redundant bit SYC for taking frame synchronization is outputted to the data REF in which identification code ID which shows the base station concerned, and the present number of users are shown. It is outputted by time sharing from each base station by the timing signal from the frame timing signal generating section 112, and intersects perpendicularly also with the diffusion sign for which mobile stations in the spectrum diffusion section 114, and spectrum diffusion is carried out by the common common diffusion sign to each mobile station, and this signal TR is transmitted through the transmission-and-reception splitter 118.

[0011] In the receive section of a base station, the data signal from a mobile station is received and the back diffusion of electrons is performed in the spectrum back-diffusion-of-electrons section 116, and in the recovery section 117, the modulation technique of the frame is presumed and it gets over. And the modulation technique MIB which was specified, Symbol MIB, i.e., the mobile station, inserted in the posterior part of a frame, and which a base station transmits with degree frame is taken out, and it tells to the adaptation modulation section 110 for information data. The presumed approach of the modulation technique in the recovery section 117 is performed by judging the symbol MIM which shows the modulation technique of the frame which the current mobile station inserted in the frame anterior part of the information data TI outputted from a mobile station has transmitted. Moreover, since the control section which omitted illustration knows communication with which mobile station it is, the diffusion sign corresponding to the mobile station used in the spectrum diffusion section 111 in the case of transmission and reception and the spectrum back-diffusion-of-electrons section 116 is selected based on the information.

[0012] Next, the presumed approach of the interference wave level in a base station is described. You may think that it depends for the interference wave level of the signal from a mobile station on the number of users then connected in approximation. So, in the interference wave presumption section 115 of a base station, the relation between the range of the number of users and a modulation technique is defined beforehand, a modulation technique is defined from the number of users which is making current connection, and it considers as the symbol MIM sent to a mobile station. If there are few users and the number of users will increase using a modulation technique with many multiple values, it will be below a predetermined transmission error rate, and they will enable it to transmit more amount of information here, as the number of users and the relation of a modulation technique use a modulation technique with few multiple values.

[0013] Next, actuation of a mobile station is described. In a mobile station, the back diffusion of electrons of received data is performed using the diffusion sign assigned to the local station in the spectrum back-diffusion-of-electrons section 124, and the information data TI are taken out, and the modulation technique MIM which was specified from the symbol MIM, i.e., a base station, inserted in the posterior part of information data and which a mobile station transmits with degree frame is taken out, and it tells to the adaptation modulation section 120 at the same time it presumes a modulation technique and gets over in the recovery section 125. In the adaptation modulation section 120, the data of degree frame are transmitted using the told modulation technique. At this time, the symbol which shows that modulation technique MIM is inserted in the anterior part of a frame. Moreover, in the spectrum back-diffusion-of-electrons section 122, the back diffusion of electrons of the pattern TR for interference wave level presumption from a base station is performed using the aforementioned common diffusion sign. In the interference wave presumption section 123, presumption and frame synchronization of interference wave level are performed as follows from the received pattern TR for interference wave level presumption. In addition, the presumed approach of the modulation technique in the recovery

section 125 is presumed from the symbol MIB which shows the modulation technique of the frame by which current transmission is carried out inserted in the anterior part of a frame like the time of a base station.

[0014] Next, the presumed approach of the interference wave level in a mobile station is described. The pattern TR for interference wave level presumption which the back diffusion of electrons was carried out and was taken out in the spectrum back-diffusion-of-electrons section 122 can consider that the power of the pattern TR is the received power for one channel from the base station which transmitted TR at the time, although it gets over like data in the interference wave presumption section 123. Since I and Q component are usually taken out by rectangular detection on the occasion of a recovery as the detection approach of this received power, it can ask by the operation of 1/2 from this component (I2+Q2). Moreover, since the number of users and identification code ID under communication in the base station concerned are contained in Pattern TR as mentioned above, when received power of the pattern TR from a base station j is made into Pj and the number Uj of users, the interference wave presumption section 123 detects Pj of the sequential above, and Uj from the pattern TR for interference wave presumption sent by time sharing, as shown in drawing 4 R> 4, and is [Equation 1]. The total received power Pt is computed by Pt=sigma UjPj. Furthermore, the interference wave presumption section 123 detects the power Pm of the information data which the mobile station concerned received from spectrum back-diffusion-of-electrons section 124 output, and is [Equation 2] as interference wave level D/U. D/U=Pm/(Pt-Pm)

********. And according to this interference wave level D/U, a modulation technique is determined like the case of a base station, and let it be the symbol MIB which shows the modulation technique at the time of the transmission from the next base station. This symbol MIB is sent to the adaptation modulation section 120, is added to each frame posterior part of information data, and is transmitted to a base station.

[0015] The PE with which source resultant pulse numbers as shown, for example in drawing 5 differ as an example of the modulation technique in a base station or a mobile station is used. In this example, the interference wave level presumed in the interference wave presumption section of a base station or a mobile station is divided into three fields, and the threshold which determines that field is set to A and B (A<B). At this time, if it interference-wave level <=A Becomes, it A< interference-wave level <=B Comes to use 8PSK and it will be QPSK and B< interference wave level, a modulation output will be carried out by BPSK. Of course, a modulation technique may use for example, pi / 2 shift BPSK, pi / 4 shifts QPSK, etc. for everything [above] but three kinds. And it sets up so that the modulation technique of the number of multiple values which can transmit the information on many in the range in which a predetermined error rate can realize A and B as possible can be chosen.

[0016] According to the CDMA adaptation modulation system of this invention explained above, each of a base station and a mobile station The symbol which presumes the interference wave level of the input signal of a local station, determines the modulation technique with if possible many amounts of information transmissions which can be transmitted below by the transmission error rate predetermined in the bottom of the interference wave level, and shows the modulation technique by telling about to a distant office with data Even if a symbol rate is fixed, rather than the conventional method, average transmission capacity is increased and a deployment of a frequency can be aimed at. Moreover, the monitor means of interference wave level is formed in a mobile station, and if it moves to the location where interference wave level is small and is made to perform data transmission between base stations, it will become convenient when high-speed data transmission is required.

[0017] Drawing 2 is the block diagram showing another example of a configuration of the CDMA adaptation modulation system which becomes this invention, and the same circuit as drawing 1 attaches the same sign. Differing from the configuration of drawing 1 is the point that the spectrum diffusion section 211 of a base station and the spectrum back-diffusion-of-electrons section 224 of a mobile station are made to perform not only information data but diffusion or the back diffusion of electrons of an interference wave presumption pattern. Of course, to information data, it is a diffusion sign corresponding to a mobile station, and a common diffusion

sign is used to an interference wave presumption pattern. Although information data and an interference wave presumption pattern are diffused and transmitted with this configuration by the diffusion sign which intersects perpendicularly, since its diffusion / back-diffusion-of-electrons means is based on the same hardware, it cannot transmit to coincidence like drawing 4 .

[0018] Corresponding to this, a transmission format of the information in the system of drawing 2 is considered as a configuration like drawing 6 . That is, from each base station, information data DAT A, the information data with which one of them consists of a symbol MIB of the anterior part and a hind symbol MIM, and the pattern P for interference wave level presumption are transmitted to time sharing. For this reason, if it is looking in one base station, with the frame to which the pattern P for interference wave level presumption is not transmitted, the time zone which a transmitting output stops intermittently will arise from that base station.

[0019] If the above-mentioned difference is removed, this system will operate like the system of drawing 1 R> 1, and will be useful to a deployment of a frequency too. Although circuitry becomes somewhat easy in the comparison with drawing 1 , since the die length of an informational transmission frame decreases like drawing 6 , only in the part, transmission efficiency will fall.

[0020] In addition, in the system of drawing 1 and drawing 2 explained above, each station determines the suitable modulation technique of a distant office from interference wave level by the local station mutually, and notifies it to a distant office, a distant office shall transmit with data the symbol which shows the modulation technique while becoming irregular by the notified modulation technique, and those who received this shall get over by reading the method. However, since the modulation technique of a distant office transmits from a local station from the first and it notifies, in the receiving side, the modulation technique of the distant office in degree frame is known. Therefore, even if a transmitting side does not transmit the symbol which shows its modulation technique, he memorizes the modulation technique of the distant office of which the partner was notified, and it may be made to perform a recovery with degree frame in a receiving side using it.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the example of the CDMA adaptation modulation structure of a system which becomes this invention.
[Drawing 2] It is the block diagram showing another example of a configuration of the CDMA adaptation modulation system which becomes this invention.
[Drawing 3] It is the explanatory view of a CDMA system.
[Drawing 4] It is drawing showing the transmission format in the system of drawing 1 .
[Drawing 5] It is drawing showing the example of a modulation technique.
[Drawing 6] It is drawing showing the transmission format in the system of drawing 2 .
[Description of Notations]
110 Adaptation Modulation Section
111, 114, 211 Spectrum diffusion section
112 Frame Timing Signal Generating Section
113 Interference Wave Presumption Pattern Generating Section
115 Interference Wave Presumption Section
116 Spectrum Back-Diffusion-of-Electrons Section
117 Recovery Section
120 Adaptation Modulation Section
121 Spectrum Diffusion Section
122, 124, 224 Spectrum back-diffusion-of-electrons section
123 Interference Wave Presumption Section
125 Recovery Section

[Translation done.]

引用文献6

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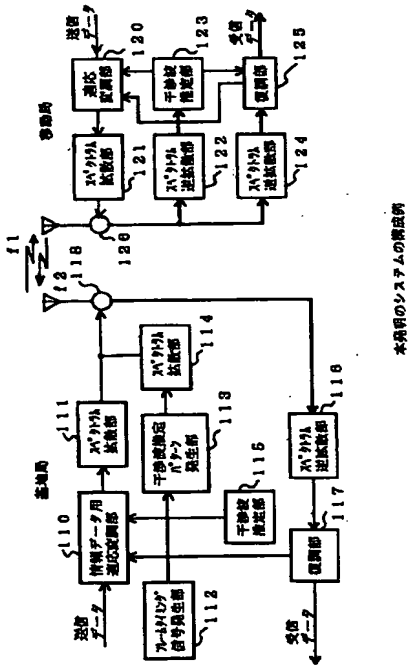
(54)【発明の名称】　ＣＤＭＡ適応変調方法とそのシステム

(57)【要約】
【課題】　上り、下り回線で別の周波数を用いるＣＤＭＡシステムで、適応変調方式を実現し、周波数の有効利用をはかる。
【解決手段】　基地局及び移動局では干渉波推定部１１５及び１２３で相手局からの受信波の干渉波レベルを推定し、相手局が次に送信するときの変調方式を定めてデータとともに相手局へ送る。各局は送られてきた変調方式でもって次のフレームのデータを情報データ用適応変調部１１０及び適応変調１２０で変調し、送信する。各基地局では干渉波推定パターンに使用中チャネル数と基地局のＩＤを入れ、これをどの移動局用の拡散符号とも直交する共通拡散符号で拡散して基地局から移動局へ送り、これを参照して各移動局は干渉波レベルの推定を行う。



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【特許請求の範囲】

【請求項１】　基地局及び移動局に於いて送信データによりディジタル変調された被変調信号をスペクトラム拡散して相手局へ送信するとともに、基地局から移動局への下り回線の周波数とその逆方向の上り回線の周波数とが異なるＣＤＭＡシステムの、前記ディジタル変調方式を適応的に変化させるＣＤＭＡ適応変調方法であって、
基地局及び移動局の各々は、自局の受信波の内の希望信号成分と干渉信号成分の比を表す干渉量を検出し、
予め定められた複数のディジタル変調方式の内から、前記検出した干渉量のもとで伝送誤り率が所定値以下となりかつ最も多くの情報量が伝送できる変調方式を選択し、
該選択した変調方式を示すシンボル情報を送信データとともに相手局へ送信することによって相手局の次回のデータ伝送時のディジタル変調方式を決定するようにしたことを特徴とするＣＤＭＡ適応変調方法。

【請求項２】　基地局における前記干渉量の検出は、当該基地局において使用中のチャネル数にもとづいて行うことを特徴とする請求項１記載のＣＤＭＡ適応変調方法。

【請求項３】　各基地局から干渉波推定用パターンを、全ての移動局に対して共通でかつ全ての移動局に割り当てられている拡散符号のいづれとも直交するところの共通拡散符号によりスペクトラム拡散を行って送信し、これを移動局で抽出することによって移動局における前記干渉量の検出を行うことを特徴とする請求項１記載のＣＤＭＡ適応変調方法。

【請求項４】　各基地局からの前記干渉波推定用パターンの送信は、各基地局が同時に行わないように、かつデータの伝送フレームごとに１つの基地局から送信されることを特徴とする請求項３記載のＣＤＭＡ適応変調方法。

【請求項５】　前記干渉波推定用パターンは、少なくとも当該干渉波推定用パターンを送信した基地局を示す識別コードと当該基地局において使用中のチャネル数とを含み、各移動局は、前記干渉波推定用パターンの受信レベルと該干渉波推定用パターンに含まれている使用中のチャネル数の積を前記干渉波推定用パターンに含まれている識別コードの示す基地局からの全受信電力とし、こうして求められた各基地局からの全受信電力の和と自局宛のデータ信号の受信レベルとから前記干渉量を検出することを特徴とする請求項４記載のＣＤＭＡ適応変調方法。

【請求項６】　基地局及び移動局は、相手局から伝送されてきた前記シンボル情報の示す変調方式でディジタル変調を行って次のフレームの伝送を行うとき、前記シンボル情報をデータとともに相手局へ送信して相手局での当該フレームのディジタル復調方式を決定するようにしたことを特徴とする請求項１記載の適応変調ＣＤＭＡ方法。

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【請求項７】　基地局及び移動局は、相手局へ前記シンボル情報を送った次のフレームでの受信データのディジタル復調方法を、前記送ったシンボル情報から決定するようにしたことを特徴とする請求項１記載のＣＤＭＡ適応変調方法。

【請求項８】　基地局の各々が、
移動局の１つから当該基地局への送信波が受ける干渉量を推定し、該推定した干渉量のもとで伝送誤り率が所定値以下となりかつ最も伝送容量の大きいディジタル変調方式を予め定められた複数のディジタル変調方式から選択し、該選択したディジタル変調方式を示す移動局シンボルを出力するための基地局干渉量推定手段と、
送信データの１フレームごとに前記基地局干渉量推定手段から出力された移動局シンボルを付加して送信データフレームを構成し、入力された基地局シンボルの示すディジタル変調方式でもって前記送信データフレームにより変調を行うための、チャネルごとに設けられた基地局適応変調手段と、
移動局に於ける受信波の干渉量を推定するための干渉波推定パターンを、各基地局で時間的に重ならないタイミングで生成するための干渉波推定パターン発生手段と、
前記基地局適応変調手段の出力を、当該適応変調手段対応のチャネルに接続されている移動局に与えられている拡散符号によりスペクトラム拡散するための、前記チャネルごとに設けられた第１のスペクトラム拡散手段と、
前記干渉波推定パターン発生手段の出力を、全ての移動局に与えられた拡散符号の全てと直交し、かつ全ての基地局で共通の拡散符号でもってスペクトラム拡散するための第２のスペクトラム拡散手段と、
移動局からの送信波を、当該移動局対応の拡散符号を用いてスペクトラム逆拡散するための、各チャネルごとに設けられた基地局スペクトラム逆拡散手段と、
該基地局スペクトラム逆拡散手段の出力を復調して移動局から送信されてきたデータと基地局シンボルとを取り出し、該基地局シンボルを前記基地局適応変調手段へ入力するための基地局復調手段と、
を備えるとともに、移動局の各々が、
当該移動局対応の拡散符号を用いて受信波のスペクトラム逆拡散を行うための第１のスペクトラム逆拡散手段と、
前記共通拡散符号を用いて受信波のスペクトラム逆拡散を行い前記干渉波推定パターンを出力するための第２のスペクトラム逆拡散手段と、
前記第１のスペクトラム逆拡散手段の出力を復調して基地局から送信されてきたデータと前記移動局シンボルを取り出すための移動局復調手段と、
前記第２のスペクトラム逆拡散手段の出力から、当該移動局への送信波が受ける干渉量を推定し、該推定した干渉量のもとで伝送誤り率が所定値以下となりかつ最も伝

送容量の大きいディジタル変調方式を予め定められた複数のディジタル変調方式から選択し、該選択したディジタル変調方式を示す基地局シンボルを出力するための移動局干渉量推定手段と、

送信データの１フレームごとに前記移動局干渉量推定手段から出力された基地局シンボルを付加して送信データフレームを構成し、前記移動局復調手段から出力された移動局シンボルの示すディジタル変調方式でもって前記送信データフレームにより変調を行うための移動局適応変調手段と、

該移動局適応変調手段の出力を、当該移動局対応の拡散符号によりスペクトラム拡散するための移動局スペクトラム拡散手段と、

を備えたことを特徴とするＣＤＭＡ適応変調システム。

【請求項９】　前記基地局適応変調手段へ入力される送信データフレームと前記干渉波推定パターン発生手段からの干渉波推定パターンが時間的に重ならないタイミングで生成されるように構成するとともに、前記基地局の第１及び第２のスペクトラム拡散手段を、１つのスペクトラム拡散手段を時分割で使用するように構成し、さらに前記移動局の第１及び第２のスペクトラム逆拡散手段を、１つのスペクトラム逆拡散手段を時分割で使用するように構成したことを特徴とする請求項８記載のＣＤＭＡ適応変調システム。

【請求項１０】　前記基地局干渉量検出手段は、当該基地局に於て使用中のチャネル数にもとづいて前記干渉量の推定を行うことを特徴とする請求項８または９記載のＣＤＭＡ適応変調システム。

【請求項１１】　前記干渉波推定用パターンは、少なくとも当該干渉波推定用パターンを送信した基地局を示す識別コードと当該基地局において使用中のチャネル数とを含み、前記移動局干渉量検出手段は、前記干渉波推定用パターンの受信レベルと該干渉波推定用パターンに含まれている使用中のチャネル数の積を前記干渉波推定用パターンに含まれている識別コードの示す基地局からの全受信電力とし、こうして求められた各基地局からの全受信電力の和と自局宛のデータ信号の受信レベルとから前記干渉量を検出することを特徴とする請求項８または９記載のＣＤＭＡ適応変調システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ディジタル変調信号をスペクトラム拡散して伝送するときの変調方式を適応的に選択するようにしたＣＤＭＡ適応変調システムとその方法に係わり、特にディジタル移動無線用に好適なＣＤＭＡ適応変調システムとその方法に関する。

【０００２】

【従来の技術】図３は、移動無線システムにスペクトラム拡散方式を用いたＣＤＭＡシステム（Code Division Multiple Access System）の説明図で、移動局３２、３

２、・・・毎に異なる拡散符号（互いに直交する符号）を用いることにより、同一セル内で同一周波数を共有するシステムである。即ち、基地局３１からの送信周波数をｆ1、移動局からの送信周波数をｆ2とすれば、同一周波数に複数のチャネルが重畳していることになるが、各々の移動局３２、３２、・・・で使用する拡散符号が互いに直交するように設定することにより各チャネルを分離できる。また、無線信号は広い帯域幅を持つことから、周波数選択制フェージングや歪み、干渉波や妨害に強く、秘匿性にも優れており、陸上移動通信に用いられている。

【０００３】

【発明が解決しようとする課題】図３では１つの基地局のみを示したが、実際には同一セル内に複数の基地局が存在する場合もあり、１つの移動局にはこれらの基地局からの複数チャネルの送信波だけでなく、隣接したセルからの送信波も入ってきて、これらはすべて周波数ｆ１の信号である。各基地局へ到来する周波数ｆ2の送信波についても同様である。ＣＤＭＡシステムでは、これらの多数の送信波から拡散符号の直交性を用いて所望のチャネルの送信波のみを取り出さねばならない。しかし、各ユーザ間の拡散符号の直交性は完全でないため、歪み成分がユーザの数の増大とともに干渉波となって増加する。従って同一セル及び隣接セルからの干渉量の総和で自ずと使用可能なチャネル数は制限され、各チャネルの情報伝送速度等の変調パラメータは、仮定する最大のユーザ数の下での最大干渉量に対してある一定の伝送誤り率を満足するように決められている。

【０００４】ところが、実際には、設定されたチャネル数全てをユーザが使用していることはまれであり、また地域によっては、チャネルの使用頻度が特に低い地域もある。そのためかなり高い時間率で、回線使用中のユーザ数が少ないことにより伝播路の干渉量が減少し伝播路状況が良好になっている。このような場合、より高速な伝送が可能であるにもかかわらず、従来は起こりうる最大干渉量により制約された伝送速度でしか伝送できないことから、実質の回線の情報伝送能力からみて周波数利用効率に無駄が多かった。つまり状況によってはもっと高速、大量なデータ伝送が可能な状況であるにもかかわらず、固定レートであるため、例えばマルチメディア化で求められる高速、大量なデータ伝送に対応できないという欠点があった。

【０００５】本発明の目的は、周波数利用効率を向上させるために、干渉波レベルに応じてディジタル変調の変調方式を適応的に変化させるようにしたＣＤＭＡ適応変調システムとその方法を提供するにある。

【０００６】

【課題を解決するための手段】上記の目的を達成するために、本発明では、基地局及び移動局に於いて送信データによりディジタル変調された被変調信号をスペクトラ

ム拡散して相手局へ送信するとともに、基地局から移動局への下り回線の周波数とその逆方向の上り回線の周波数とが異なるＣＤＭＡシステムの、前記ディジタル変調方式を適応的に変化させるＣＤＭＡ適応変調方法であって、基地局及び移動局の各々は、自局の受信波の内の希望信号成分と干渉信号成分の比を表す干渉量を検出し、予め定められた複数のディジタル変調方式の内から、前記検出した干渉量のもとで伝送誤り率が所定値以下となりかつ最も多くの情報量が伝送できる変調方式を選択し、該選択した変調方式を示すシンボル情報を送信データとともに相手局へ送信することによって相手局の次回のデータ伝送時のディジタル変調方式を決定するようにしたことを特徴とするＣＤＭＡ適応変調方法を提供する。

【０００７】さらに本発明では、基地局の各々が、移動局の１つから当該基地局への送信波が受ける干渉量を推定し、該推定した干渉量のもとで伝送誤り率が所定値以下となりかつ最も伝送容量の大きいディジタル変調方式を予め定められた複数のディジタル変調方式から選択し、該選択したディジタル変調方式を示す移動局シンボルを出力するための基地局干渉量推定手段と、送信データの１フレームごとに前記基地局干渉量推定手段から出力された移動局シンボルを付加して送信データフレームを構成し、入力された基地局シンボルの示すディジタル変調方式でもって前記送信データフレームにより変調を行うための、チャネルごとに設けられた基地局適応変調手段と、移動局に於ける受信波の干渉量を推定するための干渉波推定パターンを、各基地局で時間的に重ならないタイミングで生成するための干渉波推定パターン発生手段と、前記基地局適応変調手段の出力を、当該適応変調手段対応のチャネルに接続されている移動局に与えられている拡散符号によりスペクトラム拡散するための、前記チャネルごとに設けられた第１のスペクトラム拡散手段と、前記干渉波推定パターン発生手段の出力を、全ての移動局に与えられた拡散符号の全てと直交し、かつ全ての基地局で共通の拡散符号でもってスペクトラム拡散するための第２のスペクトラム拡散手段と、移動局からの送信波を、当該移動局対応の拡散符号を用いてスペクトラム逆拡散するための、各チャネルごとに設けられた基地局スペクトラム逆拡散手段と、該基地局スペクトラム逆拡散手段の出力を復調して移動局から送信されてきたデータと基地局シンボルとを取り出し、該基地局シンボルを前記基地局適応変調手段へ入力するための基地局復調手段と、を備えるとともに、移動局の各々が、当該移動局対応の拡散符号を用いて受信波のスペクトラム逆拡散を行うための第１のスペクトラム逆拡散手段と、前記共通拡散符号を用いて受信波のスペクトラム逆拡散を行い前記干渉波推定パターンを出力するための第２のスペクトラム逆拡散手段と、前記第１のスペクトラム逆拡散手段の出力を復調して基地局から送信されてきたデータと前記移動局シンボルを取り出すための移動局復調手段と、前記第２のスペクトラム逆拡散手段の出力から、当該移動局への送信波が受ける干渉量を推定し、該推定した干渉量のもとで伝送誤り率が所定値以下となりかつ最も伝送容量の大きいディジタル変調方式を予め定められた複数のディジタル変調方式から選択し、該選択したディジタル変調方式を示す基地局シンボルを出力するための移動局干渉量推定手段と、送信データの１フレームごとに前記移動局干渉量推定手段から出力された基地局シンボルを付加して送信データフレームを構成し、前記移動局復調手段から出力された移動局シンボルの示すディジタル変調方式でもって前記送信データフレームにより変調を行うための移動局適応変調手段と、該移動局適応変調手段の出力を、当該移動局対応の拡散符号によりスペクトラム拡散するための移動局スペクトラム拡散手段と、を備えたことを特徴とするＣＤＭＡ適応変調システムを提供する。

【０００８】

【発明の実施の形態】以下、本発明の実施の形態を説明する。図１は、本発明になるＣＤＭＡ適応変調システムの構成例を示すブロック図で、１つの基地局と１つの移動局とを示している。同図に於て、基地局は送信データを変調するための情報データ用適応変調部１１０、その変調出力をスペクトラム拡散するスペクトラム拡散部１１１、フレームタイミング信号発生部１１２、干渉波推定パターン発生部１１３、その出力パターンをスペクトラム拡散するスペクトラム拡散部１１４、干渉波推定部１１５、送受分波器１１８、スペクトラム逆拡散部１１６、及び復調部１１７等から成っており、一方移動局は、送信データを変調するための適応変調部１２０、その変調出力をスペクトラム拡散するスペクトラム拡散部１２１、干渉波推定パターンを取り出すためのスペクトラム逆拡散部１２２、その出力から干渉波を推定するための干渉波推定部１２３、データ信号を取り出すためのスペクトラム逆拡散部１２４、その出力を復調するための復調部１２５、及び送受分波器１２６等から成っている。なお、適応変調部１１０、スペクトラム拡散部１１１、スペクトラム逆拡散部１１６、復調部１１７は、その基地局で同時に送受信可能なチャネル数分設置されている。

【０００９】図４は、本ＣＤＭＡ適応変調システムにおけるデータの伝送フォーマットを示すもので、３つの基地局と１つの移動局から送信される信号を示している。各基地局からの送信信号はいづれも周波数ｆ1であり、移動局からのそれは周波数ｆ２が用いられる。なお、基地局２、３の情報データＴＩの詳細は図示を省略している。以下、この図面を参照しながら、図１のシステムの動作を説明する。

【００１０】まず、基地局では情報データ用適応変調部１１０から情報データＴＩを出力する。この情報データ

ＴＩの各フレームは、図４に示すように、その前部に移動局から指定された変調方式を示すシンボルＭＩＢ（現在基地局が送信している変調方式を示すシンボル）、後部に次フレームで移動局が送信する変調方式を指定するシンボルＭＩＭが挿入されている。スペクトラム拡散部１１１では情報データ用適応変調部１１０からの情報データＴＩを、各移動局毎に互いに異なる拡散符号を用いてスペクトラム拡散し出力する。（図４では１つの信号のみを示している）一方、干渉波推定パターン発生部１１３からは、当該基地局を示す識別コードＩＤと現在のユーザ数を示すデータＲＥＦに、フレーム同期を取るための冗長ビットＳＹＣを挿入した干渉波レベル推定用パターンＴＲを出力する。この信号ＴＲは、フレームタイミング信号発生部１１２からのタイミング信号により、各基地局から時分割で出力され、スペクトラム拡散部１１４において、どの移動局用の拡散符号とも直交し、かつ各移動局に対して共通な共通拡散符号によりスペクトラム拡散され、送受分波器１１８を介して送信される。

【００１１】基地局の受信部では、移動局からのデータ信号を受信し、スペクトラム逆拡散部１１６で逆拡散を行い、復調部１１７でそのフレームの変調方式を推定し復調する。そしてフレームの後部に挿入されているシンボルＭＩＢ、即ち移動局から指定された、基地局が次フレームで送信する変調方式ＭＩＢを取り出し、情報データ用適応変調部１１０へ伝える。復調部１１７での変調方式の推定方法は、移動局から出力される情報データＴＩのフレーム前部に挿入された、現在移動局が送信しているフレームの変調方式を示すシンボルＭＩＭを判定することにより行う。また、送受信の際のスペクトラム拡散部１１１、スペクトラム逆拡散部１１６で用いる移動局対応の拡散符号は、図示を省略した制御部がどの移動局との交信かを知っているので、その情報にもとづいて選定される。

【００１２】次に基地局での干渉波レベルの推定方法について述べる。移動局からの信号の干渉波レベルは、近似的にそのときに接続されているユーザ数に依存すると考えてよい。そこで基地局の干渉波推定部１１５では、ユーザ数の範囲と変調方式との関係を予め定めておき、現在接続しているユーザ数から変調方式を定め、移動局へ送るシンボルＭＩＭとする。ここでユーザ数と変調方式の関係は、ユーザ数が少なければ多値数の多い変調方式を用い、ユーザ数が多くなれば多値数の少ない変調方式を用いるようにして、所定の伝送誤り率以下でかつより多くの情報量の伝送が行えるようにする。

【００１３】次に移動局の動作について述べる。移動局では、スペクトラム逆拡散部１２４で自局に割り当てられた拡散符号を用いて受信データの逆拡散を行って情報データＴＩを取り出し、復調部１２５で変調方式を推定して復調すると同時に、情報データの後部に挿入されているシンボルＭＩＭ、すなわち基地局から指定された、移動局が次フレームで送信する変調方式ＭＩＭを取り出し、適応変調部１２０へ伝える。適応変調部１２０では、その伝えられた変調方式を用いて次フレームのデータを送信する。この時フレームの前部にその変調方式ＭＩＭを示すシンボルを挿入する。また、スペクトラム逆拡散部１２２では、前記の共通拡散符号を用いて基地局からの干渉波レベル推定用パターンＴＲの逆拡散を行う。干渉波推定部１２３では、受信した干渉波レベル推定用パターンＴＲから干渉波レベルの推定とフレーム同期を下記のようにして行う。なお、復調部１２５での変調方式の推定方法は、基地局の時と同様にフレームの前部に挿入されている、現在送信されているフレームの変調方式を示すシンボルＭＩＢから推定する。

【００１４】次に移動局においての干渉波レベルの推定方法について述べる。スペクトラム逆拡散部１２２で逆拡散されて取り出された干渉波レベル推定用パターンＴＲは、干渉波推定部１２３でデータと同様に復調されるが、そのパターンＴＲの電力は、その時点においてＴＲを送信した基地局からの１チャネル分の受信電力とみなせる。この受信電力の検出方法としては例えば、復調に際しては通常直交検波によりＩ、Ｑ成分が取り出されるので、この成分から（I^2+Q^2）$^{1/2}$の演算により求めることができる。またパターンＴＲには前記のように当該基地局での交信中のユーザ数と識別コードＩＤが含まれているので、基地局ｊからのパターンＴＲの受信電力をＰｊ、ユーザ数Ｕｊとすると、干渉波推定部１２３は図４に示したように時分割で送られてくる干渉波推定用パターンＴＲから順次上記のＰｊ、Ｕｊを検出し、

【数１】$Pt=\Sigma UjPj$

によって全受信電力Ｐｔを算出する。さらに干渉波推定部１２３は、スペクトラム逆拡散部１２４出力から当該移動局の受信した情報データの電力Ｐｍを検出し、干渉波レベルＤ／Ｕとして

【数２】$D/U=Pm/(Pt-Pm)$

を求める。そして、この干渉波レベルＤ／Ｕに応じて、基地局の場合と同様にして変調方式を決定し、それを次の基地局からの送信時の変調方式を示すシンボルＭＩＢとする。このシンボルＭＩＢは適応変調部１２０へ送られ、情報データの各フレーム後部に付加され、基地局へ送信される。

【００１５】基地局または移動局に於ける変調方式の具体例としては、例えば図５に示したような相数の異なる位相変調方式を用いる。この例では基地局または移動局の干渉波推定部で推定した干渉波レベルを３つの領域に分け、その領域を決定するしきい値をＡ、Ｂ（Ａ＜Ｂ）としている。この時、干渉波レベル≦Ａならば８ＰＳＫを用い、Ａ＜干渉波レベル≦ＢならばＱＰＳＫ、Ｂ＜干渉波レベルならばＢＰＳＫで変調出力する。もちろん、変調方式は上記の３種類の他に、例えばπ／２シフトＢＰＳＫ、π／４シフトＱＰＳＫ等を用いてもかまわな

い。そして、Ａ、Ｂを所定の誤り率が実現できる範囲でなるべく多くの情報を伝送可能な多値数の変調方式を選べるように設定しておく。

【００１６】以上に説明した本発明のＣＤＭＡ適応変調システムによれば、基地局及び移動局の各々が、自局の受信信号の干渉波レベルを推定し、その干渉波レベルの下で所定の伝送誤り率以下で伝送可能な、なるべく情報伝送量の多い変調方式を決定し、その変調方式を示すシンボルをデータとともに相手局へ知らせることで、シンボルレートが一定であっても従来の方式よりも平均的伝送容量を増大させ、周波数の有効利用をはかることができる。また、移動局に干渉波レベルのモニタ手段を設け、干渉波レベルの小さい場所へ移動して基地局との間のデータ伝送を行うようにすれば、高速なデータ伝送が必要なときに便利になる。

【００１７】図２は、本発明になるＣＤＭＡ適応変調システムの別の構成例を示すブロック図で、図１と同一の回路は同一符号を付している。図１の構成と異なっているのは、基地局のスペクトラム拡散部２１１と移動局のスペクトラム逆拡散部２２４が、情報データのみでなく、干渉波推定パターンの拡散または逆拡散も行うようにしている点である。勿論情報データに対しては移動局対応の拡散符号で、干渉波推定パターンに対しては共通拡散符号が用いられる。この構成では情報データと干渉波推定パターンとは直交する拡散符号で拡散されて送信されるが、その拡散／逆拡散手段が同一のハードによっているので、図４のように同時に送信することはできない。

【００１８】このことに対応して、図２のシステムに於ける情報の伝送フォーマットは図６のような構成とする。即ち各基地局からは情報データＤＡＴＡとその前部のシンボルＭＩＢ及び後部のシンボルＭＩＭからその１フレームが構成される情報データと、干渉波レベル推定用パターンＰとは時分割に送信される。このため、１つの基地局で見ていると、その基地局から干渉波レベル推定用パターンＰが送信されないフレームでは、送信出力が間欠的に停止する時間帯が生じる。

【００１９】上記した相違点を除けば、本システムは図１のシステムと同様に動作し、やはり周波数の有効利用に役立つ。図１との比較では、回路構成が少し簡単になるが、情報の伝送フレームの長さが図６のように減少するから、その分だけ伝送効率が低下することになる。

【００２０】なお、以上に説明した図１、図２のシステムでは、各局は互いに相手局の適切な変調方式を自局で干渉波レベルから決定してそれを相手局へ通知し、相手局はその通知された変調方式で変調するとともにその変調方式を示すシンボルをデータとともに送信し、これを受けた方はその方式を読み取って復調を行うものとしている。しかし、相手局の変調方式はもともと自局から送信し通知したものであるから、受信側では次フレームでの相手局の変調方式は判っている。従って、送信側は自分の変調方式を示すシンボルを送信しなくても、受信側では自分が相手に通知した相手局の変調方式を記憶しておき、それを用いて次フレームでの復調を行うようにしてもよい。

【００２１】

【発明の効果】本発明によれば、適応変調を下りと上り回線で別の周波数を用いたＣＤＭＡ方式に適用できるから、伝送可能な容量を増大させることができ、周波数の有効利用に効果がある。

【図面の簡単な説明】

【図１】本発明になるＣＤＭＡ適応変調システムの構成例を示すブロック図である。

【図２】本発明になるＣＤＭＡ適応変調システムの別の構成例を示すブロック図である。

【図３】ＣＤＭＡシステムの説明図である。

【図４】図１のシステムに於ける伝送フォーマットを示す図である。

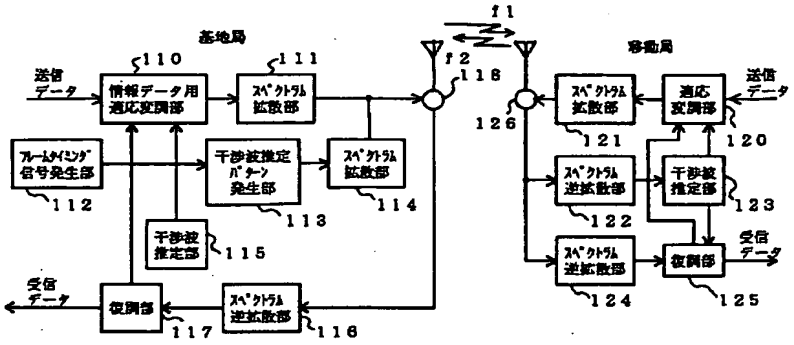
【図５】変調方式の例を示す図である。

【図６】図２のシステムに於ける伝送フォーマットを示す図である。

【符号の説明】

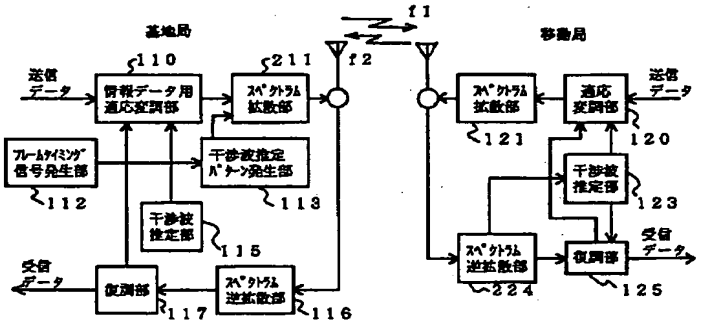
１１０　適応変調部
１１１、１１４、２１１　スペクトラム拡散部
１１２　フレームタイミング信号発生部
１１３　干渉波推定パターン発生部
１１５　干渉波推定部
１１６　スペクトラム逆拡散部
１１７　復調部
１２０　適応変調部
１２１　スペクトラム拡散部
１２２、１２４、２２４　スペクトラム逆拡散部
１２３　干渉波推定部
１２５　復調部

【図1】



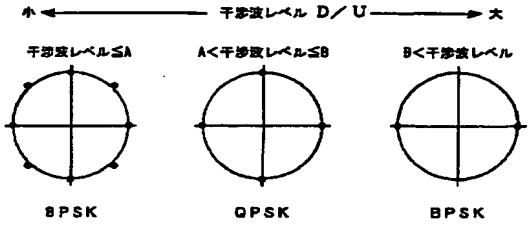
本発明のシステムの構成例

【図2】

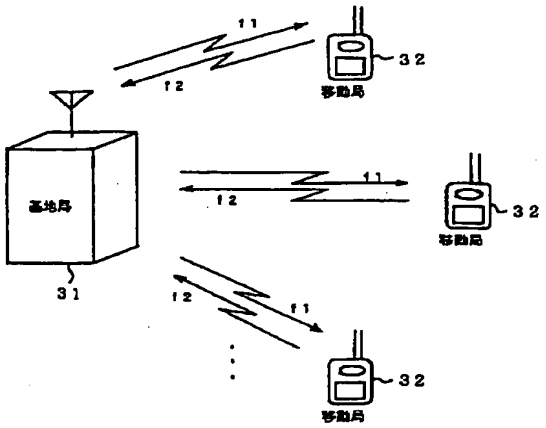


本発明のシステムの構成例

【図5】

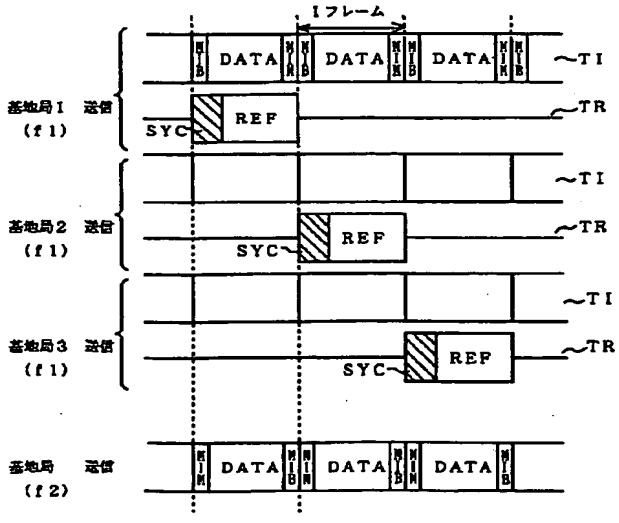


【図3】

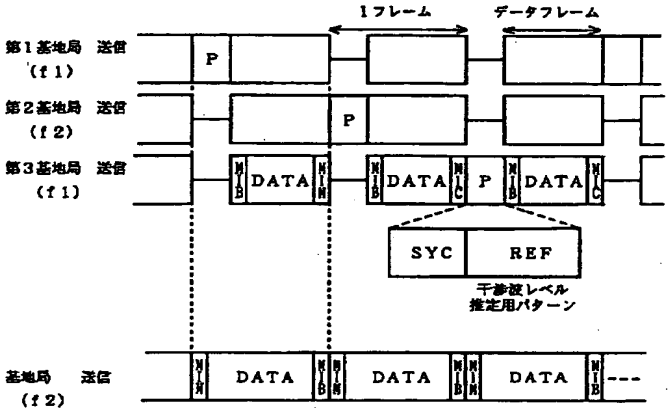


CDMA システム

【図4】



【図６】


1フレーム
データフレーム
第1基地局 送信
(f1)
第2基地局 送信
(f2)
第3基地局 送信
(f1)
基地局 送信
(f2)
P
DATA
SYC
REF
干渉波レベル
推定用パターン